GLOSSARY

Notation

Symbol	Units	Term
A_c	sq ft	Cross-sectional area of the navigation channel from the free surface to the bottom.
A_s	sq ft	Cross-sectional area of the wetted ship, usually equal to the beam times the draft.
B	ft	Beam of the ship; maximum ship width at the design waterline, usually the molded beam.
B_d	ft	Beam of the design ship.
B_t	ft	Beam of the traffic ship.
B_R		Channel blockage ratio, cross-sectional area divided by the ship cross-sectional area.
C_B		Ship block coefficient; the ratio of the ship displaced volume to the length times beam times draft.
C_S		Ship coefficient of slenderness, length over volume of displacement to one-third power.
C_z		Ship sinkage coefficient, characteristic of hull form, empirically measured as about 1.5.
C_Θ		Ship trim coefficient, characteristic of hull form, empirically measured as about 1.0.
d	ft	Channel cross-section mean depth.
D	ft	Diameter of anchored ship swing; size of single anchored ship “watch circle.”
F_P		Froude number based on ship length.
		Ship speed over the square root of length times g.
F_h		Froude number based on channel depth of water; ship speed over the square root of depth times g, the acceleration of gravity.

F_L		Schijf limiting Froude number in a canal, based on one- dimensional squat theory.
g	ft/sec^2	The acceleration, as a result of gravity, approximately 32.2 ft/sec/sec.
$\overline{GM_l}$	ft/sec^2	Longitudinal metacentric height.
$\overline{GM_T}$	ft/sec^2	Transverse metacentric height.
h	ft	Depth of water in a navigation channel from the water surface to the bottom.
h_b	ft	Depth of water at which waves break.
H	ft	Wave height, the vertical distance from the wave crest or peak to wave trough; generally, significant wave height.
H_o	ft	Deep water significant (Average of the highest 1/3 waves) wave height.
H_2	ft	Translated local significant wave height.
k		Relationship of transverse radius of gyration to the ship's beam.
k_1		Relationship of longitudinal radius of gyration to the ship's length.
L, L_{BP},	ft	Alternative notations for ship.
L_{PP}		Length between perpendiculars; common definition of ship length.
L_{OA}	ft	Ship length definition based on overall length dimension from the farthest point on the ship bow to the aftermost point on the stern.
L_{WL}	ft	Ship length definition based on length at the ship design waterline.
N		Number of ships at anchorage for use in anchorage size design.
p		Probability of exceedence.
P	ft	Penetration of ship hull below the still water line in response to wave action.
P_{avg}	ft	Average bow or stern excursion during a transit.
P_{max}	ft	Maximum ship excursion ship due to heave, pitch, and roll.
$P_{(p)}$	ft	Average bow or stern excursion with a probability of (1-p) of not being exceeded.

P_{tot}	ft	Total ship vertical penetration resulting from waves below the still water surface.
R	ft	Radius of navigation channel curve, from channel centerline to center of curvature.
T	ft	Ship draft; vertical distance from the loaded ship waterline to the keel; usually, the molded ship draft.
T_e	sec	Encounter period.
T_θ	sec	Natural roll period.
T_ϕ	sec	Natural pitch period.
T_w	sec	Water wave period.
U	knot	Ship return velocity; in canal squat analysis, the speed increase of the water between the ship and channel sides above the ship speed.
U_L	knot	Limiting return velocity at the Schijf limiting speed.
V	knot	Ship speed in the axial ship direction; the speed of the ship in the surge direction.
V_s	knot	Ship service speed; the design sustained sea speed of a ship, normally rated at 80 % of full engine power.
W	ft	Navigation channel width; topwidth of canal section in squat analysis.
W_1	ft	Channel bottom width for one- way ship traffic.
W_2	ft	Channel bottom width for two-way ship traffic.
V	ft/sec	Ship speed.
V_L	knot	Schijf limiting ship speed in squat analysis.
z	ft	Ship sinkage (vertical drop of ship center of gravity) when underway in shallow water.
z_{max}	ft	Total vertical ship motion resulting from sinkage and running trim; ship squat in shallow water.
Z	ft	Approximate maximum ship squat for low ship speeds.

Z_s	ft	Schijf squat based on one-dimensional canal theory.
Z_w	ft	Ship heave response due to wave action.
Z_L	ft	Ship squat at the Schijf limiting ship speed.
δ	deg	Deflection angle at navigation channel turn.
λ	ft	Water wave length; the horizontal distance between adjacent wave crests in the direction of wave advance.
λ_o	ft	Deep water wave length.
λ_2	ft	Translated local wave length.
μ	deg	Encounter angle.
π		The ratio of the circumference to the diameter of a circle; approximately 3.14159.
Θ	rad	Trim angle of ship, positive is bow up.
ΔW	ft	Local increase in channel width at a turn.
Δ	tons	Weight displacement of a floating ship, usually given at design draft; normally equal to the weight of salt water displaced.
∇	cu ft	Volume displacement of a ship; equal to volume of salt water displaced by the floating ship.

Terms

Abeam
To one or both sides of a vessel; at right angles to the vessel centerline.

Advanced Maintenance
Overdepth maintenance dredging to provide a greater channel depth or width than authorized in areas of high shoaling rates. The purpose is to increase the time interval for dredging cycles and thus decrease overall project cost.

Aft
Near, toward, or at the ship stern.

After Perpendicular (AP)
The vertical line perpendicular to the ship keel line through the intersection of the ship design water line and the after side of the rudderpost or sternpost.

Afterbody
The portion of the ship hull aft or abaft of amidships.

Ahead
Moving in a forward direction; as opposed to astern.

Aids to Navigation
Markers with known charted positions located and designed to enable mariners to avoid dangers and fix their positions. Examples are buoys, ranges, and electronic aids.

Amidship
(a) In the center of a vessel; in the vicinity of the ship hull midlength. Midway between the forward and after (fore-and-aft) perpendiculars (FP and AP).
(b) In ship piloting, the order to bring the rudder to the zero angle position on the vessel center line.

Amplitude
The maximum value of a fluctuating or oscillating (usually periodic) variable or quantity from the mean value. For a harmonic sinusoidal water wave, the amplitude is one-half the wave height.

Anchor
A heavy device, usually of metal, fastened to a chain or line to hold a vessel in position. Also applied to hold any other floating object, such as a buoy. Anchors hold by weight and by digging into the sea bottom.

Anchorage
A customary, suitable, and usually designated area in a harbor set aside for vessels to anchor and await berthing space, repairs, etc. A sheltered area in a harbor reserved, legally or by custom, for anchoring vessels. Usually designated by the U.S. Army Corps of Engineers and depicted on appropriate nautical charts.

Answer
To move in response to a rudder movement, as a vessel yawing to port when given left rudder. A ship is said to answer to the helm when the rudder position is changed.

Astern
The movement of a vessel in a backward direction; opposite of ahead.

Athwartship
Across the ship, at right angles to the fore-and-aft hull center line; across a vessel from side to side.

Authorized Channel Depth
The depth of a Corps navigation project as authorized by Congress and as presented in the appropriate design documents. The water depth usually available in an official Federal channel referred to a local datum, such as mean lower low water (mllw).

Automatic Pilot
A vessel steering system designed to maintain a course from feedback information on ship course deviation, ship location, and other ship data, and provide compensating rudder changes to minimize course deviation.

Azimuth
The horizontal, clockwise angular arc from the north reference point to some other object or point, such as the ship's heading.

Ballast
Additional weight (usually water) placed in the vessel hull to provide static stability and improve maneuverability. Usually provided in unloaded vessels; a ship "in ballast" is an unloaded vessel.

Bar
A submerged embankment or shoal area of usually sandy material extending partly across the entrance channel into a harbor where wave effects are important. Bar pilots are locally licensed to guide ships from the open sea through the bar and into the harbor.

Basin
A comparatively large excavated space at a dock or in a waterway or channel, configured to permit the turning or other maneuvering of vessels to enter a dock or berth or depart from port.

Bathymetry
The measurement or portrayal of the underwater portion of navigation channels, coastal areas, or ocean topography; typically, a map of a region with depths and contours shown over the area.

Beacon
A fixed aid-to-navigation marker located on the edge of a channel or in shoal water for use by mariners.

Beam
One of the three principal dimensions of a ship; the width of a vessel in a transverse horizontal direction at its widest point, usually amidship.
Molded Beam. The maximum transverse dimension of a ship to the outside edge of the hull structural members excluding the shell plate. Usually measured amidships at the design water line to the inside of the ship hull plating on each side.
Extreme Beam. The width of a ship including the hull plating and any permanently installed underwater or abovewater projecting or overhanging gear, such as sonar domes or lifeboats.
Water-line Beam. The maximum molded beam at the design water line.

Bearing
The angular direction or orientation of an object with respect to an observer. Bearings may be compass or relative depending on the reference line whether from north or with respect to the ship longitudinal direction.

Bend
A channel turn that is designed as a continuous curve with a given radius; usually provided for large channel changes (or turn angles) in direction.

Berth
A vessel position at a dock or wharf for loading or unloading cargo and designed to provide safe mooring. More generally, a place where a vessel is moored at a wharf or lies at anchor. Generally, the space allocated to a vessel when secured at a pier or float, either moored or at anchor.

Bilge
The corners of a ship cross section, usually rounded, where the side of the hull meets the ship bottom. A bilge keel or fin is often fitted to the ship hull at the "turn of the bilge" to reduce rolling.

Blockage
The degree to which a ship area takes up a channel cross-sectional area; the hydrodynamic effects of the flow around the ship from the channel banks and boundaries.

Block Coefficient (C_B)
The nondimensional ratio of the displacement volume (underwater volume) of the molded form of a ship to the volume of a rectangular block with the main ship dimensions of the effective length, beam, and draft. The molded beam and draft to the specified water line (which is usually the design water line) and the length between perpendiculars are used to calculate the block coefficient. A measure of ship "fullness" or "fineness."

Boat
A generic term to refer to any of several watercraft of relatively small size; a small vessel, usually less than 50 ft in length. May be propelled by sails, oars, or some kind of motor engine.

Body Plan
A ship drawing that is part of the ship lines drawings showing two half end views of a ship, a bow view as seen from ahead and a stern view as seen from astern. The body plan also shows the form of the ship at the various cross sections.

Bollard Pull
The pull or push of a vessel, such as a tug or towboat, exerted at zero speed ahead. Generally, equal to the vessel propeller thrust and used as a means of rating tug capability.

Bow Wave
The wave set up by the bow of a vessel while moving through the water.

Bow
The forward part of a ship or vessel. Generally, the forward 10 percent of the length of the ship hull where most of the hull curvature (flare) is located.

Breakwater
A structure made of riprap, stones, or concrete blocks built to reduce wave effects and create a harbor or improve navigation conditions at a harbor entrance channel.

Bridge
The control room of a vessel; also called a wheelhouse or pilothouse. An overhead structure over water to carry pedestrians, vehicles, or railroad traffic.

Bring About
To reverse direction of a vessel. The maneuver executed in a turning basin prior to or after docking.

Broaching
An involuntary and dangerous change in vessel heading produced by a severe following or quartering sea. A sudden and uncontrolled turning of a ship so that the hull is broadside to the waves. Sometimes leads to capsizing without strong corrective action.

Bulkhead Line
A demarcation line defined in a harbor to denote the extent to which banks may be filled and bulkheads built for the purpose of port development. Piers may extend beyond the bulkhead lines but must be open in construction, such as on pilings.

Buoy
Floating marker moored to the bottom in a specific place used as an aid to navigation marking the edge of channels or indicating wrecks, rocks, or other navigation hazards.

Can
A flat-topped cylindrical buoy painted green used to mark the port or left side of a channel.

Canal
An excavated watercourse, usually artificially cut through land area, without any existing channel, designed for navigation. Canal edges or borders usually extend above the water surface with visible banks and important ship and bank interaction effects.

Captain
A title bestowed on the person in charge of a vessel while underway. The master of a ship.

Cast Off
To loosen and unfasten mooring lines from a vessel to a dock preparatory to departure from a berth in a port or harbor. The start of an outbound ship transit from a port to sea.

Center of Gravity (CG)
The point center at which the total weight of a ship, including the hull structure, acts. The total weight is considered as concentrated in the longitudinal, vertical, and horizontal axis at the CG. The origin of the coordinate axis used to describe list, trim, and dynamic ship motions from waves and in maneuvering.
Longitudinal Center of Gravity. Distance measured from midships to the center of gravity (MG).
Vertical Center of Gravity. Distance measured from the keel to the center of gravity (KG).
Transverse Center of Gravity. Distance measured from the ship center line to the center of gravity (TG).

Channel
The deeper, navigable portion of a waterway, usually marked and designated on the appropriate navigation charts with known widths and depths. Part of a watercourse used as a fairway for the passage of shipping. May be formed totally or in part through excavation, such as dredging.

Channel Depth
The vertical distance from the water surface to the bottom of a channel; normally referred to some datum, such as mean lower low water (mllw) in a tidal channel.

Channel Limit
The location of the authorized channel as designated on project design documents and depicted on hydrographic survey sheets. Often provided as a channel width on navigation charts.

Charts
Maps of water areas provided to mariners and intended for navigation. Charts usually provide land and underwater depth data as well as location of aids to navigation. Other useful navigation information, such as shore contours, hazards, and landmarks are also provided.

Conn
To oversee the steering of a vessel by watching her course and directing the helmsman. To be in charge of the navigation and control of a ship; a pilot directing a ship into harbor.

Controllability
A subjective term used to describe the apparent adequacy of response to ship control by the mariner; the inherent quality of a ship to stay on track.

Controlling depth
Actual (as measured) minimum depth of a navigable waterway or channel at its shallowest point. The least depth of water available for navigation in a channel. This depth controls the draft of loaded ships that may safely enter a harbor or port.

Coupling
The influence of one mode of motion on another; coupling between pitch and heave.

Course
The intended direction in which a vessel is to be steered. A straight leg of a vessel's route from one point to another in a voyage.

Coursekeeping
(a) The mariner's primary task of providing steering control to maintain a given ship course or track between navigation channel turns or way points.
(b) The quality of a ship to maintain a course and stability to return to that track after an outside force or impulse.

Course Made Good
The direction of a line connecting two points describing the start and end of a desired ship track. The course covered by a vessel with respect to the bottom; the course sailed with an allowance for the effects of current and wind (leeway).

Crabbing
Vessel sideways drifting due to wind or other effects. To cause a ship to head into a crosswind or crosscurrent by the appropriate use of rudder to counteract drift. The projected ship width is greater than the ship beam and is a function of the drift angle. To drift sideways from current or wind; to make leeway.

Crosscurrent
The magnitude of the tidal or river current component perpendicular to the channel center line or intended ship track.

Current
A generic term referring to the horizontal movement of water caused by various forces, as river currents or tidal currents. Currents may be described by magnitude and direction, the latter being presented as the angle toward which the current flows. The direction of a current is called its set, and the speed is referred to as its drift. A fair current is favorable with respect to the ship sailing direction; a ship in a contrary or adverse current is said to be "stemming the tide." Currents across a ship's bow are called crosscurrents and have a major effect on ship piloting and navigation, especially in harbors when ship speeds are normally reduced.
Tidal Current. The reversing horizontal movement of water associated with the rise and fall of the tide caused by the astronomical tide-producing forces.
Ebb Current. The tidal current away from shore and toward the sea; usually downstream in a tidal stream and associated with a decrease in tide height.
Flood Current. The tidal current toward shore or up a tidal stream; usually associated with an increase in tide height.
Strength. The peak speed of current in either direction, as strength of ebb.
Slack. The period of time during the tide when current is at or nearly zero and not discernable in direction.

Cutoff Turn
A method of providing increased ship maneuvering room around a channel turn by dredging the inside corner of the apex of a turn. Thus the channel width is increased locally by adding a triangular area in the turn.

Datum
The plane or level to which soundings, elevations, tide heights, and channel depths are referenced. Usually, some low-water datum is used, such as mean lower low water (mllw).

Deadweight Tonnage (dwt)
The rated carrying capacity of ships in tons. The capacity will vary with actual ship draft. The total weight of cargo, stores, crew, fuel, fresh water, etc., which a ship can carry. The difference between the loaded and light displacement tonnages. Usually given in metric tons today, but also rated in long tons for older vessels.

Deck
A platform in a ship consisting of plating covering beams corresponding to the floor of a building. The main or freeboard deck is the uppermost continuous deck with the capability of sealing off all hatches and openings against the sea.

Deep-Draft Channel
Navigation channels (usually excavated, as by dredging) provided for the movement of self-propelled vessels with drafts of more than about 5 m (15 ft). Includes channels for seagoing and Great Lake ships and other vessels usually designed for international trade and commerce.

Depth
(a) The vertical dimension in a transverse plane from the bottom of the ship hull to the top of the main or freeboard deck measured at the ship midlength. Not to be confused with the ship draft, which is smaller. The depth is equal to the freeboard plus the draft.
(b) The vertical distance from the channel bottom to the still water surface, usually based on a specified water datum. See also *Molded Depth*.

Design Vessel
A hypothetical or real ship with dimensions of the largest vessels that a navigation project is designed to accommodate.

Dimensions
The main measurements used to describe the ship geometry consisting of the length, beam, depth, freeboard, and draft. Usually given as molded dimensions, which refer to the outside of the hull frame structure, but inside the ship plating.

Directional Stability
The relative tendency for a ship to stay on, return to, or to deviate from its original track after an outside disturbance. A stable ship will tend to return to or stay on track after the disturbance; deviations from the original track will tend to increase after the disturbance if the ship is unstable. Usually, directional stability is specified with the rudder fixed at amidships (0 deg).

Displacement
The mass of the salt water at standard conditions displaced by the floating ship. The displacement will vary with the ship loading condition, i.e., the draft. When expressed in long tons, the displacement is equal to the total weight of the ship.
Light Displacement. The mass of the ship itself, including the hull, machinery, equipment, liquids in the machinery, permanent ballast, but without any cargo or fuel and other expendables, and with the ship ready for loading and service.
Loaded Displacement. The displacement of a ship when floating freely, usually at her greatest allowable (design) draft. Equal to the mass of water displaced and to the sum of the light displacement and the deadweight.
Displacement Volume. The volume of the equivalent saltwater displacement mass. Can be calculated by multiplying the displacement in tons by the unit volume of salt water.

Dock
A general term referring to various structures along a port waterfront to accommodate ships and their cargo; wharves, piers, terminals, etc. The water space between adjacent piers or wharves in which vessels are berthed and cargo is loaded or unloaded.

Dolphin
A cluster of piles driven into the bottom.

Draft
The submerged depth of a ship below the water line measured vertically to the lowest part of the hull. Generally, the minimum depth of water in which a ship will float.
Molded Draft. The draft of a ship measured to the molded hull form, which is to the inside edge of the hull plating. This is the draft specified in ship design and normally listed in tables of ship particulars.
Keel Draft. The draft measured to the extreme bottom of the ship keel and normally used as the reference for the ship displacement calculations and the reference marks painted on the ship.
Summer Load Draft. Standard ship draft when in fully loaded condition compatible with the summer navigation season load line freeboard allowance for normal oceangoing, registered cargo-carrying ship assignment in seawater. The summer load draft is marked on ships (called the Plimsoll lines) horizontally through the center of a ring with the registering authority designated on the marking.
Design Draft. Ship draft used to design the ship; distance from the design load waterline (LWL) to the bottom of the keel. The maximum draft to which the ship can be safely loaded.
Partially Loaded Draft. A ship draft less than the maximum allowable, either design or summer load draft; partially loaded ship.
Ballasted Draft. The average ship draft without any cargo load. The minimum ship draft, which is usually obtained by filling the ship ballast tanks, required for adequate maneuverability and to submerge the ship propeller and rudder.
Forward Draft. The ship draft at the forward perpendicular; the draft at the ship bow.
After Draft. The ship draft at the after perpendicular; the draft at the ship stern.
Mean Draft. The average of the forward and after draft of a ship.
Scantling Draft. The maximum allowable draft at which a ship complies with the classification society requirements for the ship's frame and hull structural strength. Usually used when the scantling draft is different from the maximum design draft corresponding to the classification society's load line convention, which assigns the minimum freeboard and maximum permissible draft.

Drift Angle
The angular offset of the resultant vessel track from the desired target track caused by drift. The angular difference between the ship heading and the direction of ship motion about the center of gravity.

Drift
Deviation of a ship from an intended course from wind or currents. The sideways motion of a vessel from its track as it makes its transit through a waterway. Side drift (drift angle) is the difference between the intended track or leading line and the longitudinal ship axis. The speed of a tidal or other water current.

Effective Lane Width
The total maneuvering lane width requirement for a ship because of a combination of the ship track width and the cross-channel projection of the ship due to yaw.

Entrance
That portion of the ship length forward of the parallel middle body. The forward part of a ship from the bow to the end of the curved section.

Entrance Channel
The main access channel into a bay, harbor, or port.

Even Keel
The condition of a ship in an upright position with her keel floating parallel to the water surface without any trim.

Excursion
Total movement at any particular location of a ship in the vertical or horizontal direction.
Submergence. The vertical motion of a part of an oscillating ship below the still water surface due to dynamic wave effects.
Bow Submergence. Total vertical movement as a result of the combined motions of pitch and heave at the ship bow.
Stern Submergence. Total vertical movement because of the combined motions of pitch and heave at the ship stern.
Bilge (or Side) Submergence. Total vertical movement as a result of the combined motions of heave and roll at the port or starboard ship side, amidships.
Horizontal Drift. The horizontal motion of a part of an oscillating ship about an intended course from yaw and sway due to dynamic wave effects.

Fairway
A navigable pathway in an open and unobstructed waterway, such as a bay, lake, sound, or strait, usually leading into a harbor from the open sea. Includes waters convenient for navigation outside a buoyed channel, ordinarily used by vessel traffic, and so designated by appropriate authority.

Fore
The forward portion of a ship; at or adjacent to the bow.

Forebody
The portion of the ship hull forward of amidships.

Forward Perpendicular (FP)
The vertical line perpendicular to the ship keel line through the intersection of the ship design water line and the fore side of the bow (stem).

Freeboard
The vertical distance from the design water line to the surface of the main or freeboard deck at the side of the ship, amidships.

Freeboard Deck
Normally, the main or uppermost complete deck exposed to weather and sea conditions makes a main entry which has permanent hatch covers for watertight seals.

Harbor
A fully or partially enclosed body of water offering safe anchorage or reasonable shelter to vessels against adverse environmental conditions; a protected water area that may be natural, artificial, or a combination.

Heading
The horizontal direction in which a ship points or heads, usually given in degrees of azimuth.

Heave
Oscillatory vertical linear component of ship motion (up and down) about the center of gravity caused by changes in buoyant forces, normally a result of wave effects.

Heel
A transverse tilt, usually temporary, of a vessel pushed from the vertical by the wind or shifting of weight to one side; noncontinuous inclination or leaning to one side of a ship about a longitudinal axis as a result of wind forces, high-speed ship turning effects, or other nonpermanent effects.

Height of Eye
The height above the design waterline to the line of sight from the ship bridge.

Hull
The structural body and skin of a vessel, not including the superstructure, between the deck and the keel.

Hull Speed
The speed of the ship hull through the water, as contrasted to the speed of the propeller.

Hydrography
The configuration and measurement to describe the relief and depth of the underwater surface of a water body.

Ice Boom
A mechanical device (usually floating) designed to restrict the movement of ice away from navigation channels at critical waterway sites.

Jetty
A structural barrier built out from a seashore designed to confine and increase tidal currents and scour the entrance channel. Also used to protect a harbor entrance channel from wave effects and to decrease shoaling from littoral material.

Keel
The principal fore-and-aft structural member of a ship frame, located along the centerline of the hull bottom.

Landmark
A conspicuous object, natural or artificial, located near a harbor, which aids pilots in navigation. Not a part of the formal, specially designated aid-to-navigation system in a waterway.

Leeway
The leeward (away from the wind) motion of a vessel caused mainly by the wind. The off-course lateral movement of a ship through the water when underway as a result of wind and current. The resultant deviation from a vessel's true course is expressed as the angular difference between the course steered and the course made good (through the water).

Length
Generally, the longitudinal distance along a ship hull center line from the bow to the stern.
Length Overall (LOA). The extreme length of a ship hull measured from the foremost point of the stem to the aftermost part of the stern; the length from the tip of the bulbous bow to the stern overhang.
Length Between Perpendiculars (LBP). The ship length between the forward perpendicular (FP) and the after perpendicular (AP). The generally accepted characteristic ship length defined and used by naval architects for hydrodynamic analysis and design.
Length on Design Waterline (L_{WL}). The horizontal ship length between the extreme design or fully loaded water line positions at the bow and stern of the ship hull.
Length on the Waterline (LWL). The ship length used in design calculations, normally the same as the LBP.

Lighterage
The unloading of oil from a large tanker by means of smaller tankers or barges that can be accommodated in a nearby oil terminal or harbor. Lightering operations may be conducted at sea in coastal areas near an oil port or in protected waters. Sometimes used to permit the large tanker to proceed in a light-loaded condition to a terminal with limited channel depth. Sometimes used for other cargoes/ships in harbors with limited depths.

List
The inclination of a vessel at rest, usually caused by imbalance of weight. A continuous condition in which a ship is not floating in an upright position with respect to the water surface, i.e., longitudinal vertical center plane not perpendicular to the water surface. List is a static situation due to asymmetrical loading conditions and is correctable by moving cargo or changing ballast.

Maneuverability
The quality of a ship used to describe the ability to change course or to move off track while underway by the application of steering and engine controllers.

Maneuvering
That branch of naval architecture used to describe vessel response; relates the ease of changes in direction and speed with rudder and engine control parameters.

Maneuvering Lane
Portion of channel width within which a ship may deviate from a mean line while transiting through the channel and maintain safe channel bank clearances or safe distance from an approaching vessel. An allowance used in setting channel design widths. The maneuvering lane is equal to or some multiple of the swept path envelope width of ship tracks from a simulator study or field data, if available.

Model Tests
The testing of small-scale models in a towing tank or model basin to determine ship powering requirements, maneuvering capability, and seakeeping performance to help design full-scale ships.

Molded Depth
The ship depth to the outside of the structural hull frame from the molded keel to the molded deck. Also, the depth from the inside of the hull plate at the keel and molded deck plating.

Molded Form
The three-dimensional lines used by naval architects to describe the geometry of a ship hull to the outside edge of the frame or structural members. The molded lines extend to the inside edge of the ship hull plating for steel ships; the plating is typically less than 1 in. The ship beam, depth, and draft are referred to as the molded dimensions or sizes. The outside edge of the hull plating is referred to as the displacement lines or form. Ship dimensions may refer to molded or displacement beam, depth, draft, and freeboard, the difference being related to the hull plating thickness.
Molded Beam. The maximum horizontal width of a ship from the insides of the ship plating to each side of the ship, measured at the design water line, and usually at the amidship cross section.
Molded Depth. The perpendicular distance in a transverse plane from the top of the keel to the underside of the main deck plating at the ship side, usually at the amidship cross section.
Molded Draft. The perpendicular distance in a transverse plane from the top of the keel to the design water line, at amidships.

Neap Tide
Tide height variation of decreased range and resulting smaller tidal currents occurring every 2 weeks during the lunar month.

Nun
A tapered, conical-shaped buoy painted red to serve as a marker for the starboard or right side of a channel.

Overbank Depth
The depth on each side of a channel beyond the channel limits in trench (dredged) channels.

Overhead Obstructions
Any structure built above and across a navigable waterway that could cause navigation hazards or problems. Examples are highway, railroad, or pedestrian bridges and overhead power lines, conveyors, or pipelines.

Paddlewheel Effect
The tendency for the ship propeller to develop a sideways force (propeller side force or bias). With reverse propeller and a right-handed screw, the ship will back with a tendency of the stern to go to port; this will cause the ship bow to turn to starboard.

Period of Encounter
The time interval between successive crests of a train of waves as observed from a moving ship.

Penetration
The maximum depth or submergence of a vessel when it is responding to wave motion.

Pier
A structure, usually of open construction, extending out into the water from land to serve as a berthing place for navigational vessels.

Pile
A long, heavy timber, concrete, or steel member for driving into the earth to serve as a support or protection.

Pilot
An expert shiphandler with specific qualifications and knowledge of local waters hired for ship navigation into and out of a harbor. The person directing and controlling the maneuvering of a vessel is normally locally licensed to guide vessels through a waterway.

Pitch
The oscillatory rotation (angular component of the motion) about the ship's center of gravity (alternating bow up, stern down) about the transverse (lateral) axis. Pitch is the dynamic equivalent of static trim.

Pivot Point
The point about which a ship actually turns; not the same as the ship center of gravity or midpoint. The pivot point varies as the ship is maneuvered and depends on all forces and moments acting on the ship.

Port
(a) A place in which vessels load and discharge cargoes and passengers. Facilities normally include berths, cargo handling equipment and personnel, cargo storage facilities, and land transportation connections. Often with a city, town, or industrial complex.
(b) The left side of a vessel, while facing forward; to turn to the left.

Quay
A stretch of paved bank or solid, developed dock parallel to a navigable waterway for use in loading and unloading vessels.

Rate of Turn
The circular speed (normally given in deg/sec or deg/min) of ship turning; the rate of change of course heading.

Reef
A rocky shoal at or near the surface of the water, sometimes exposed at low tide and constituting a hazard to navigation.

Restricted Water
A navigable waterway sufficiently narrow to cause hydrodynamic responses on the ship due to channel banks.

Roll
The oscillatory angular component of ship motion (transverse rotation around the ship center of gravity) leaning alternately to the port and starboard sides about the longitudinal (fore and aft) ship axis. Roll is the dynamic motion equivalent of the static ship list and usually caused by wave action.

Rudder Area
The projected area of the movable part of the rudder.

Rudder Area Ratio
The ratio of the rudder area to the gross underwater area (normally L_{BP} H draft) of the ship hull. This ratio is an important parameter in determining ship maneuverability.

Rules of the Road
Any of various codes of regulations used to govern vessel traffic in navigable waters to reduce collision and improve safety.

Running Trim
The increase in trim due to dynamic flow effects when a ship is underway. Running trim occurs in deep water, but increases significantly as a ship moves into shallow water and even higher in restricted water, such as a canal. The amount of change in at-rest and underway ship drafts at the bow and stern is a measure of the running trim. Magnitude of running trim will change with ship design and speed.

Scantling
The nominal dimensions of a ship's hull structural steel members, such as girder sizes, frames, plating, etc.

Sea
Nonperiodic, irregular, wind-generated waves produced by a local storm at the place and time of importance to a ship transit. Seas consist of waves with a large range of periods that produce a wide-band spectrum, generally with smaller energy at the higher periods.

Sea Direction
The direction of encounter of a ship moving through a train of sea waves.
Beam Sea. A condition in which a ship and waves advance toward each other at right angles.
Bow Sea. A condition in which a ship and waves advance at oblique angles to each other.
Following Sea. A condition in which a ship and waves advance in the same direction; seas coming from astern.
Head Sea. A condition in which a ship and waves advance in opposite directions; waves coming from dead ahead.
Quartering Sea. A condition in which a ship and waves advance at oblique directions; waves coming from halfway between abeam and astern.

Seakeeping
That branch of naval architecture that seeks to describe vessel response to waves by using theory and testing of ship models.

Set
The amount of deflection from a desired ship course; the direction toward which a current flows.

Shallow Water
A descriptive term to characterize navigation in waterways where the depth of water is shallow enough to cause significant ship hydrodynamic responses. Normally, at depth to draft ratios of 5 or less.

Sheer
A wide swing or turn of a vessel off course while underway. A ship in a channel sailing off the channel center line is said to take a sheer toward the opposite bank from the off-center line bank.

Ship
A self-propelled, decked vessel used in oceangoing, deep-water navigation for military purposes or waterborne commerce.

Shoal
An area of shallow water, usually near a channel or in a waterway, usually consisting of deposited material, and particularly considered a hazard to navigation.

Significant Wave
A statistical definition of waves relating to the one-third highest waves of a given, irregular wave group given by the average of their heights and periods.
Significant Wave Height. The average height of the one-third highest waves in an irregular pattern.
Significant Wave Period. The period of the one-third highest waves with an irregular pattern in a wave group.

Simulator
A facility with capabilities to apply computer-based mathematical models, ship bridge consoles, and visual graphical imagery to produce realistic ship maneuvering response for use in evaluating ship or waterway design and for training and research.

Sinkage
The vertical bodily drop of a ship when underway as a result of the generation of following waves and dynamic pressures on and near the underwater portion of the ship hull. Ship sinkage occurs in deep water but becomes larger and more important in shallow water and even higher and more critical in restricted water, such as canals. The amount of sinkage is the difference in the at-rest and underway ship drafts at midships.

Slipstream
The stream of water thrust aft by a rotating propeller.

Speed
The magnitude of the motion of a vessel, usually in a longitudinal direction, either ahead or astern.
Speed Over Ground. Vessel speed relative to the bottom or a fixed earth that includes the effects of water currents.
Speed Through the Water. Vessel speed relative to the water, after subtracting for the effects of water currents.

Squat
The total drop of a ship in motion due either to sinkage plus running trim or to water level depression; the change in the at-rest and underway ship underkeel clearances.
Shallow-Water Squat. The ship squat in a wide, unbounded, shallow-water region is the sum of sinkage and running trim at the ship bow or stern, whichever is higher. Slender ship theory in unrestricted shallow water (very wide channel) is used to calculate squat.
Canal Squat. The ship squat in a canal is the water level depression due to increased flow of the water past the moving ship. The squat can be calculated using a one-dimensional form of the Bernoulli and continuity equations taking into account the ship blockage in the canal.

Stability
The property of a vessel that tends to restore it to its original state after some disturbance.

Starboard
The right side of a ship, while facing forward; in piloting, a right turn.

Stern
The aftermost part of a ship hull.

Suction
The tendency to force a ship bodily in a transverse direction (sway force) when running close to a channel bank. Usually the ship will tend to move toward a channel bank; thus the force is called bank suction.

Surge
The longitudinal oscillatory linear motion about the center of gravity (origin of body axis) in the ship travel direction, usually due to wave effects; motion backward and forward (fore and aft direction).

Sway
The transverse oscillatory linear motion about the ship body axis; lateral or athwartship (normal to the ship heading) motion from side to side.

Swell
A long, wind-generated wave that has traveled a long distance from the storm-generation area of the ocean. Usually characterized by a long period and flat-crested wave with more regular periodicity than locally generated waves (seas). The spectrum from a swell is at higher periods than the seas and usually at a smaller range of periods (narrow-band spectra).

Swept Path
A single trace of the path of the extremities of the vessel planform as it makes its track while it transits the waterway. Account is taken of drift, drift angle, and yaw.

Swept Path Envelope
The outer boundaries of several swept paths with the most extreme deviations from target track that encompass one or more of the swept paths of the vessels that transited the waterway.

Tidal Advantage
The additional channel depth and thus ship draft that can safely be brought into a port by taking advantage of vertical tide fluctuations and the additional available water when the tide level is higher than the channel depth datum (usually mean lower low water).

Tide
The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting on the rotating earth. The tide should be distinguished from tidal current.
Range. The difference in height of water surface between consecutive high and low (or higher high and lower low) water. The mean tide range is often used to characterize harbors for navigation purposes.
Diurnal. A tide with one high water and one low water in a lunar tidal cycle.
Semidiurnal. A tide with two high and two low waters in a lunar tidal cycle.
High Tide. The maximum water elevation reached by each rising tide.
Low Tide. The minimum water elevation reached by each falling tide.
Neap Tide. Tide of decreased range and current that occurs about every 2 weeks during the lunar tidal cycle; the lowest tide.
Ebb Tide. The portion of the tide cycle during which falling tide occurs; the period between high water and the succeeding low water.
Tidal Cycle. The time of the interval between two successive transits of the moon over the local meridian, approximately 24.84 hr (24 hr and 50 min); also called the lunar day.
Spring Tide. Tide of increased range and current that occurs about every 2 weeks during the lunar tidal cycle; the highest tide.
Flood Tide. The portion of the tidal cycle between low water and the succeeding high water during a rising tide.

Tonnage
A measure of internal volumetric cargo-carrying hull capacity of a ship. Various nations and canal authorities have set up vessel measurement tonnage rules that are used to collect tolls and fees for various services. The rules are designed to have fees in proportion to the earning capability of ships, which is equal to the volumetric capacity of cargo. By international agreement, 2.8317 cu m (100 cu ft) of vessel volume is equal to one register ton. Note that this is not a weight measure and is developed using a complicated system of space allocation, deductions, and exemptions, some of which is described below.
Gross Register Tonnage. A measure of the total internal volumetric capacity of space within a ship, including superstructure, engine compartment, and other noncargo space.
Net Register Tonnage. Gross tonnage minus the volume of noncargo space, which does not earn revenue. The deductions are considered to be those spaces necessary for operating the ship. Some examples of these deductions include engine room, ballast tanks, fuel and water tanks, and crew space.

Topping Off
The practice used by shippers in taking on additional ship loads at a deeper channel port than available at the normal port. This technique is used to take advantages of favorable commodity pricing at one port and adding an incremental commodity load at some nearby deep-water port.

Total Equivalent Unit (TEU)
A measure of total carrying capacity of containerships, usually at the design draft with given loaded containers. The number of standard sized container boxes that may be on board a containership.

Tow
One or more barges or other vessels being pulled, towed alongside, or pushed ahead.

Towboat
A combination of barges lashed together in a flotilla being pushed by a high-powered vessel specially designed to operate on the shallow, inland waterways of the United States.

Track
A trace or trajectory of the path (usually the vessel center of gravity) of a vessel as it makes its transit of a waterway. A vessel's line of travel or course made good.

Transit
A passage of a vessel from point to point in a waterway.

Transverse
An athwartship direction; at right angle to the ship longitudinal axis.

Trim
The fore-and-aft attitude of the floating hull of a vessel relative to the designed, static waterline. The long-term longitudinal inclination of a ship. A long-term condition in which a ship is not floating at the designed water line or parallel to the designed waterline (uneven keel). The amount of trim may be expressed as an angle between the water line and the ship base line; more usually trim is given as the difference between the ship draft forward and the draft aft. If the draft forward is greater, the ship will "trim by the bow"; with a higher draft aft, she will "trim by the stern." Usually, trim is a result of static cargo load and ballast conditions and is controllable by cargo and ballast changes.

Tug, Tugboat
A strongly built, highly powered vessel specially designed to pull or push other vessels while maneuvering at low speeds.

Turning Basin
An open area along or (more usually) at the end of a waterway or navigation channel to allow vessels to bring about to change direction of ship transit.

Turning Circle
The circle a vessel describes when turning with rudder hard over. One of the definitive maneuvers that describe the maneuvering performance of ships.

Underkeel Clearance
The space or distance between the keel of a (usually) loaded ship and the channel bottom in a static or stillwater condition. The allowable margin of safe water for which ship passages are deemed adequate by local port authorities and pilots. The difference between the loaded ship draft and the lowest safe channel depth.

Underway
A vessel, making progress through the water, in motion, en route, not at anchor or at a berth.

Up
In ship maneuvering, usually, toward the direction in which currents are coming from or setting. Normally, an upriver or upstream direction, as in upbound. Also, sometimes referred to as positioning the ship “high.”

Veer
The act of changing direction of a vessel, usually suddenly; to swerve off course or to take a sheer, as from a current.

Vessel
A general term referring to all types of self-propelled watercraft including ships, towboats, barges, tugs, yachts, and small boats.

Visibility
The extreme distance at which an object can be seen by the naked eye, usually given in nautical miles.

Wake
The disturbance made in the water from a moving vessel; the waves and eddies resulting from the passage of the hull of a ship.

Wash
The water pushed astern by the propeller with the ship engine at thrust ahead; the propeller slipstream, jet, or propeller race so induced. The increased local velocity caused by the propeller past a ship rudder that provides rudder effectiveness in turning the ship.

Water
The quality of a water body referring to the quantity or depth of water adequate for navigation; as for example, navigable water or U.S. waters.
Shallow Water. A body of water in which the depth boundary is close enough to a ship to affect the resistance, speed, maneuvering, or other performance characteristic as compared to the performance in unlimited depth (ocean) water.
Restricted Water. A body of water in which the width boundary is close enough to a ship to affect the performance characteristics compared to open, unlimited ship performance. Principally applies to the proximity of horizontal water boundaries, as in ships sailing in canals or channels.

Waterline
The intersection line of the water surface with the loaded ship hull surface, usually in still water, but could be at design speed ahead with the normal ship motion induced waves.

Waterway
A navigable body of water connecting two or more geographical points in which vessels travel, including connecting basins, canals, and berthing areas. May be natural, man-made, or a combination of both.

Wave
A disturbance or undulation of the surface of the sea that usually moves across the water surface.
Amplitude. The maximum value of the fluctuating water surface from the mean value; for a harmonic wave, the amplitude is one-half the wave height.
Height. The vertical distance between a wave crest and the preceding trough; twice the amplitude of a harmonic wave.
Period. The time required for a wave crest to traverse a distance equal to one wavelength. The time for two successive wave crests to pass a fixed point.
Length. The horizontal distance between adjacent wave crests on two successive waves in the direction of advance.
Direction. The direction, usually the azimuth, from which a wave approaches.
Spectrum. Usually a graph showing the distribution of wave energy as a function of wave period or frequency.
Steepness Ratio. The ratio of wave height to length.

Wharf
A waterside structure, usually parallel to the waterway bank, at which a vessel may be berthed alongside from which cargo or passengers can be loaded or discharged. A pier or dock built on the shore of a harbor, river, or canal.

Wheel
A circular, spoked apparatus used to steer a ship. Also, the ship or vessel propeller.

Wind
Natural movement of air in a horizontal direction over and above the surface of the earth. The wind's direction is indicated as from a given bearing; a south wind blows from a southerly direction. The magnitude of the wind is its speed given in knots or mph, sometimes as a mean speed with gusting up to another higher speed.

Relative Wind
The apparent wind is the wind direction and force as observed from a vessel in motion. With respect to the speed and direction of a ship sailing, the relative wind is referred to as:
Head Wind. A wind blowing from the ship bow; a wind from ahead.
Beam Wind. A wind blowing across the ship beam and perpendicular to the keel.
Following Wind. A wind blowing from astern of the ship; a fair wind.

Windage
The vessel surface above the waterline exposed to the wind, which causes wind effects.

Yaw
A temporary swing off course by a vessel, usually because of waves, but may be caused by poor steering, currents, or wind. The horizontal angular deviation of a vessel's longitudinal axis from the desired line of track. The angular, oscillatory motion (rotation) about the ship vertical axis; to alternately swing to and fro off course, usually by wave action.